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REMARKS

Claims 1, 5, 7-9, 35 and 36 are now pending in the application. Claims 35 and 36 have been allowed, and Claims 1, 5, 7-9 have been further amended herein. New Claims 39 to 45 are filed herewith. Favourable reconsideration of the application as amended is respectfully requested.

I. CLAIM AMENDMENTS

Claims 1, 5 and 7-9 have been amended to meet the Examiner's objections. New Claims 39 to 45 are presented herewith.

II. ALLOWABLE SUBJECT MATTER

Applicants acknowledge with appreciation the allowance of Claims 35 and 36.

III. REJECTION OF CLAIMS 1, 5, 7-9 UNDER 35 USC 112, FIRST AND SECOND PARAGRAPHS

Claims 1, 5 and 7-9 stand rejected under 35 USC 112, second paragraph, as being indefinite. Withdrawal of the rejection is respectfully requested for the following reasons.

The terms "the adjacent coating", "the region", "the step of heating the preform", "the bond" and "the vicinity" have been replaced by alternative wording. In addition appropriate generating and melting steps have been introduced into Claim 1 as suggested by the Examiner, and the wording of Claim 5 has been amended to link it more closely to that of Claim 1.

In addition the wording used in Claims 1, 5 and 7 has been amended to comply with the written description requirement to remove the rejection under 35 USC 112, first paragraph.

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IV. REJECTION OF CLAIMS 1, 5 AND 7-9 UNDER 35 USC 103(a)

Claims 1, 5 and 7-9 stand rejected under 35 USC 103(a) as being unpatentable over DeVore in view of Yamauchi. Withdrawal of this rejection is respectfully requested for at least the following reasons.

Claims 1 and 7-9 have been amended to make it clear that the molten material from the preform is caused to flow along the optical fiber by capillary action to provide a relatively large bonding area thereby to form a bond of high strength between the optical fiber and the metallic element subsequent to cooling of the molten material. The flow of the molten material by capillary action not only provides a relatively large bonding area, which is essential to provide a bond of sufficiently high mechanical strength, but also serves to control the compressive stress exerted on the fiber in the cooled joint. In this regard both the mechanical properties and the optical properties of the fiber can be severely compromised if the fiber is stressed to too great an extent in the cooled joint, such that the fiber may easily break or may be rendered unsuitable for carrying out its intended optical transmission function. It has been demonstrated that the forming of the joint by causing the molten material to flow along the fiber by capillary action is particularly advantageous in limiting the stress gradient in the fiber (as compared with methods in which no flow of molten material by capillary action occurs).

DeVore uses a glass preform having a softening temperature of 850°C, and accordingly requires a layer of insulation to shield the ceramic feeder tube and buffer fiber from the heat (see, e.g. Fig 2 and Col. 3, lines 20 and 50). No such thermal insulation is required in the formation of a bond in accordance with the invention. The method of the invention is therefore capable of being carried out in a simpler and more reliable manner.

DeVore does not teach or suggest control of the stress in the fiber in the cooled joint by causing the molten material to flow along the fiber by capillary action. The fiber will accordingly be subjected to relatively high compressive stress as the molten material cools, and this may prejudice the mechanical and optical properties of the fiber.

Yamauchi is concerned with a process in which a tablet of low melting point glass positioned between two glass pipes is melted to provide airtight sealing of an optical

fiber passing through the glass pipes and surrounded by a metal pipe. In the preferred production process the whole assembly is heated to 440°C, and the area of the tablet is then locally heated to 550°C with the object of relieving thermal stress during heating. It should be noted that the tablet is confined between the glass pipes, and is not caused to flow by capillary action. In this manner the glass is melted quickly and distortion of the fiber due to large differences in the coefficients of linear expansion is limited (see, e.g., Col. 5, lines 30 to 44). It is to be noted that, when the tablet is melted, its apparent volume is reduced, and the glass pipes are pushed in so that any void is prevented from being formed in the molten material. The particular object of this joint is to form an airtight seal to prevent moisture passing into the package through the wall of which the fiber extends. The mechanical strength of the bond formed by the molten material is of secondary importance, since mechanical strength is imparted any case by the provision of the glass pipes on either side of the bond within the metal pipe.

Whereas the melting temperature of the glass of Yamauchi is given as 430°C (see Col. 6, line 43), this is not to be confused with the temperature of 440°C to which the whole assembly is heated in a heating furnace (see Col. 5, line 30). As is made clear in Col. 5, lines 35 to 44 of Yamauchi, a local heating temperature of 550°C or more of the glass is required in this method so that it can melt sufficiently quickly to avoid undesirable distortion of the fiber.

This contrasts with the method of the invention as claimed in amended Claim 1 in which the characteristics of the glass and its use are chosen to enable the bond to form by glass flowing in a capillary manner along the fiber to thereby provide a hermetic, strong bond. Furthermore the bond is formed sufficiently quickly and with heat being provided only locally so as not to thermally damage any of the coating of the fiber that has not previously been removed. This is possible even though the coating is only removed over a short end portion of the fiber (as opposed to the coating being removed over a relatively long intermediate length of the fiber as can clearly be seen in Figure 4 of Yamauchi) because the heat is applied only locally and for a short period of time. It is of advantage to leave the coating on the fiber as close as possible to the bond so as to protect the fiber.

It is also a particular advantage of the method of the invention that the fiber is not unduly under compressive stress in the cooled joint. This is not to be confused with the thermal stressing as referred to in Col. 4, lines 28 and 29 of Yamauchi. The stress which this invention is concerned with controlling is the mechanical stress to which the fiber is subjected as a result of compression by the cooling glass. Because of the requirement for the end of the optical fiber to be held by the bond *in a defined position* relative to the optical component within the package, it is important that the optical fiber is firmly maintained in position against vibration so that optical signals can be transmitted by the fiber with minimum insertion loss. Also it is important that a compression joint is formed in order to produce the required strong bond. However, if too strong a compression joint is formed, the fiber will be subject to excessive stress and may break, as well as adversely affecting the light transmission properties of the fiber, this being a particular problem in relation to polarisation maintaining (PM) fibers (see page 9, lines 20 to 24 of the specification).

Even if the Yamauchi glass were used in the DeVore method, this would still not result in a strong bond produced in accordance with the method of amended Claim 1 by causing capillary flow of the molten material along the optical fiber. It is also very questionable as to whether the skilled person would consider using the Yamauchi glass in the DeVore method given that Yamauchi is concerned with hermetic sealing of the passage of an optical fiber through the wall of a package, and is not concerned in any way with firm positioning of the end of an optical fiber relative to an optical component as in the present invention (or with splicing of optical fibers as in the case of DeVore). Since the Yamauchi glass requires on a combination of overall heating of the assembly and locally heating to 550°C or more for formation of a bond, there would apparently be no good reason for the skilled person to choose to us the Yamauchi glass in the DeVore method.

It is accordingly submitted that amended Claim 1 is clearly patentable over DeVore in view of Yamauchi, and for the same reasons that amended Claims 5 and 7-9 are also patentable over DeVore in view of Yamauchi.

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V. NEW CLAIMS

New Claims 39 to 45 are presented herewith, and it is submitted that this are also patentatable over DeVore and Yamauchi for the reasons already given.

VI. CONCLUSION

Accordingly all claims are believed to be allowable and the application is believed to be in condition for allowance.

Should the Examiner feel that a telephone interview would be helpful to facilitate favourable prosecution of the above-identified application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Should a petition for an extension of time be necessary for the timely reply to the outstanding Office Action (or if such a petition has been made and an additional extension is necessary), petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988.

Respectfully submitted,

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